

# **Traffic Signal Head Backplates**



**North Carolina Department of Transportation  
Division of Highways**

**Traffic Signal Technician / Contractors  
Conference**

**April 10 - 11, 2007**

**presented by:  
Greg A. Fuller, PE**

# What is a backplate?

- MUTCD - A thin strip of material that extends outward from and parallel to a signal face on all sides of a signal housing to provide a background for improved visibility of the signal indications.




# MUTCD Standard



■ NONE

# **MUTCD Guidance**

## **(Section 4D.17)**



- The use of a signal backplate for target value enhancements should be considered on signal faces viewed against a bright sky or confusing backgrounds.
- The use of backplates enhances the contrast between the traffic signal indications and their surroundings for both day and night conditions, which is also helpful to elderly drivers.

# **ITS and Signals Design Manual Requirements**



 **None**

**(Engineering Judgement - Division and Regional Traffic Engineers)**





# **Maintenance Issues**



- **Damaged Backplates (Bent / Missing Pieces)**
- **Missing Backplates**
- **Increased Loading (Increases Metal Pole Support Size)**
- **Signal Heads more prone to movement during high winds.**



MUST  
YIELD



DO NOT  
ENTER



EXXON

Self	Cash
227¢	227¢
237¢	237¢
247¢	247¢

272

2006/11/30







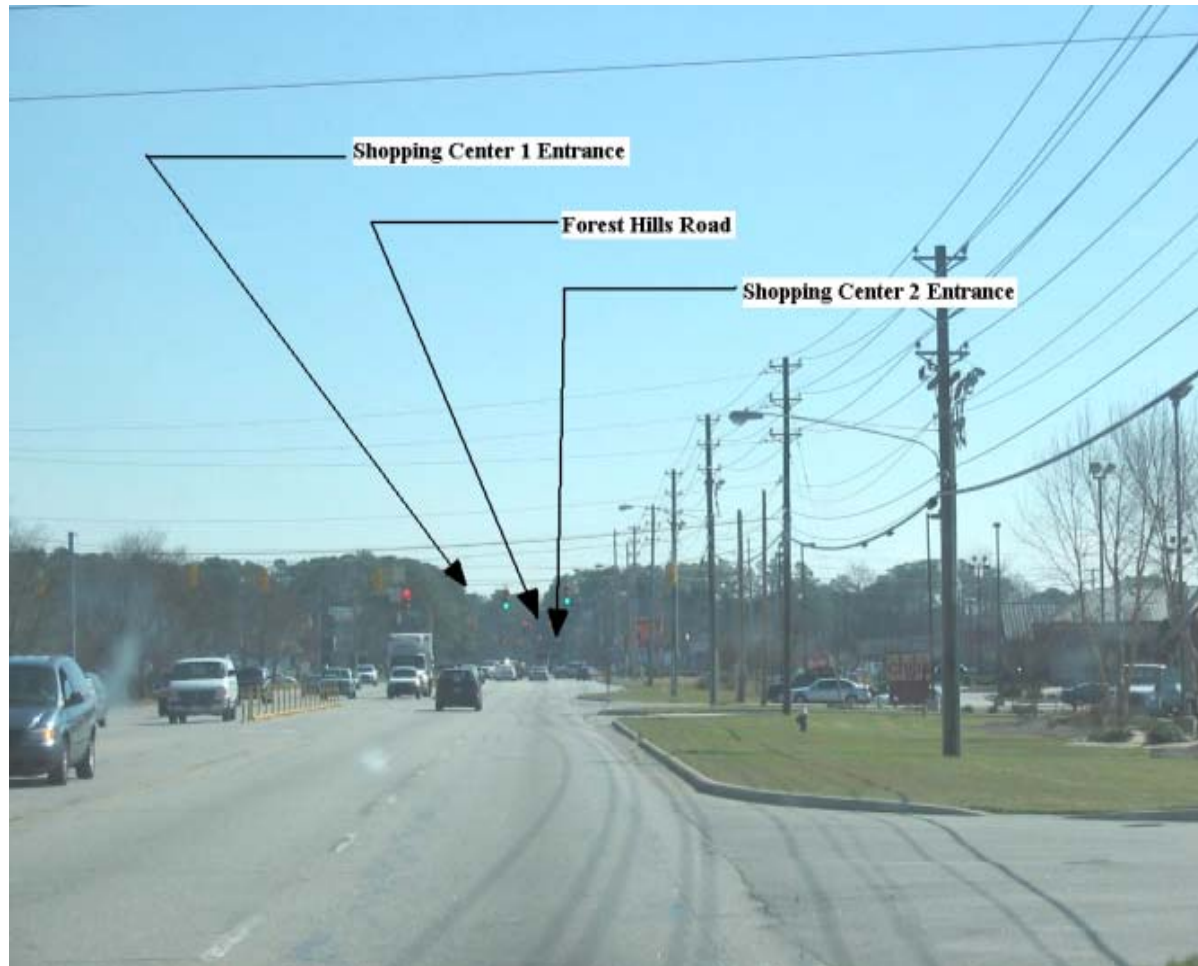




DOWNING ST

EXXON

# US 264 Alternate



- Three tightly spaced signalized intersections (approx. 1/3 mile segment).

STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS
AL	36249.2052	51g-1	2
F.A. PROJ. NO.			
PROJECT ID NO.			

# 5 PHASE FULLY ACTUATED WILSON-US 264 CLOSED LOOP SIGNAL SYSTEM

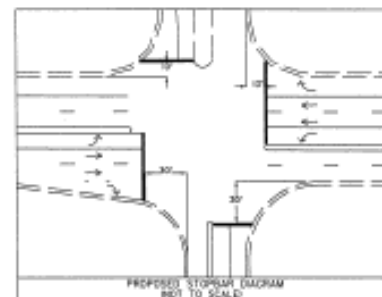
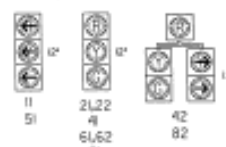
## NOTES

1. Refer to "Roadway Standard Drawings NCDD" dated January 2002, "Standard Specifications for Roads and Structures" dated January 2002 and applicable sections of the latest version of the general Project Special Provisions. The PSP can be accessed at the following website:  
<http://www.al.gov.dot.state.us/transportation/traffic/trafficspec/default.htm>
2. Run all lead-in cable overhead on existing utility poles where possible.
3. Maximum times shown in timing chart are for free-run operation only. Coordinated signal system timing values shall supersede these values.
4. Set all detector units to presence mode.
5. 332 Type cabinet shall include cabinet extension for coiled fiber optic storage.
6. 2070L Closed Loop System Data Controller Asset No. 1304 MASTER ASSET NO. 10000.
7. Contractor shall be required to obtain all type classifications and penetration test results for completion and submit a "Metal Pole Foundation Selection Form" to be approved by NCDD.

SIGNAL FACE	PHASE											
	11	12	13	14	15	16	17	18	19	20	21	22
11	11	12	13	14	15	16	17	18	19	20	21	22
21	22	23	24	25	26	27	28	29	30	31	32	33
41	42	43	44	45	46	47	48	49	50	51	52	53
42	43	44	45	46	47	48	49	50	51	52	53	54
51	52	53	54	55	56	57	58	59	60	61	62	63
61	62	63	64	65	66	67	68	69	70	71	72	73
81	82	83	84	85	86	87	88	89	90	91	92	93
82	83	84	85	86	87	88	89	90	91	92	93	94

## SIGNAL FACE I.D.

○ DENOTES I.E.D.



## K-MART ENTRANCE



## WESTPOINT SHPG CNTR

2070L LOOP & DETECTOR INSTALLATION											
INDUCTIVE LOOPS						DETECTOR PROGRAMMING					
LOOP	SIZE (FT)	THICK	OFFSET FROM STOPBAR (FT)	PHASE	CALLING	EXTENSION	CALL TIME DELAY	EXTENSION LOOP	STRETCH TIME (SEC)	DELAY TIME (SEC)	NEW CARD
1A	6'x80'	2-4-2	0'	Y	81	Y	Y	Y	Y	Y	Y
1B	6'x80'	2-4-2	0'	Y	81	Y	Y	Y	Y	Y	Y
2A/31	6'x80'	5	300'	Y	82	Y	Y	Y	Y	Y	Y
2B/32	6'x80'	5	300'	Y	82	Y	Y	Y	Y	Y	Y
4A	6'x80'	2-4-2	0'	Y	84	Y	Y	Y	Y	Y	Y
5A	6'x80'	2-4-2	0'	Y	85	Y	Y	Y	Y	Y	Y
5B	6'x80'	2-4-2	0'	Y	85	Y	Y	Y	Y	Y	Y
6A/53	6'x80'	5	300'	Y	86	Y	Y	Y	Y	Y	Y
6B/54	6'x80'	5	300'	Y	86	Y	Y	Y	Y	Y	Y
8A	6'x80'	2-4-2	0'	Y	88	Y	Y	Y	Y	Y	Y

FEATURE	PHASE							
	1	2	4	5	6	8	9	11
Min Green 1 *	7	12	7	7	12	7	7	7
Max Green 1 *	15	30	30	15	30	30	15	15
Extension 1 *	1	6	1	1	6	1	1	1
Yellow Clearance	4.0	4.7	4.0	4.0	4.7	4.0	4.0	4.0
Red Clearance	2.0	1.0	2.5	2.0	1.0	2.5	2.0	2.0
Walk 1 *	-	-	-	-	-	-	-	-
Don't Walk 1	-	-	-	-	-	-	-	-
Seconds Per Actuation *	-	1.5	-	-	1.5	-	-	-
Max Variable Initial *	-	34	-	-	34	-	-	-
Time Before Reduction *	-	15	-	-	15	-	-	-
Time To Reduction *	-	30	-	-	30	-	-	-
Minimum Gap	-	3.0	-	-	3.0	-	-	-
Recall Mode	-	MIN RECALL	-	-	MIN RECALL	-	-	-
Vehicle Call Memory	-	YELLOW	-	-	YELLOW	-	-	-
Dual Entry	-	-	ON	-	-	ON	-	-
Simultaneous Gap	ON	ON	ON	ON	ON	ON	ON	ON

\* These values may be field adjusted, do not adjust Min Green and Extension times for phases 2 and 6 lower than what is shown. Min Green for all other phases should not be lower than 4 seconds.

PROPOSED	LEGEND	EXISTING
○	TRAFFIC SIGNAL HEADS	●
○	MODIFIED TRAFFIC SIGNAL HEAD	○
○	SIGNAL POLE WITH GUY	○
○	SIGNAL POLE WITH SIDEWALK GUY	○
□	METAL STRAIN POLE	□
□	INDUCTIVE LOOP DETECTOR	□
□	CONTROLLER & CABINET	□
□	NO CABBINET EXTENSION	□
□	LOOP DETECTOR PULL BOX	□
□	2" UNDERGROUND CONDUIT	□
□	RIGHT OF WAY WITH NUMBER	□
□	DIRECTIONAL ARROW	□
□	PAYMENT MARKING ARROW	□
□	STOP BAR	□
□	U-TURN MUST YIELD SIGN R3-271	□

## NEW INSTALLATION

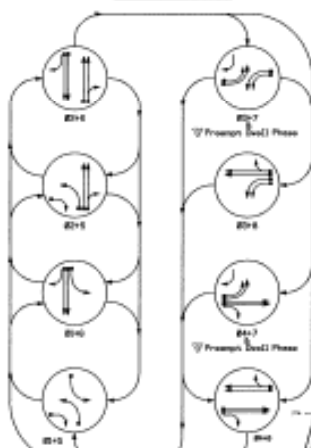
US 264 (Raleigh Rd)  
at  
Westpoint Shopping Center/  
K-Mart Entrance

DATE: 1/24/03  
BY: [Signature]  
CHECKED: [Signature]  
APPROVED: [Signature]

AL 36249.2052-1000

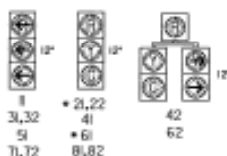
# **US 264 Alternate (First Signal) (No Backplates Eastbound)**



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SIGNAL FACE I.D.

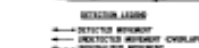
• DENOTES EXISTING BACKPLATES



8 PHASE  
FULLY ACTUATED W/ BACKUP PREEMPTION  
WILSON-US 264 CLOSED LOOP SIGNAL SYSTEM

## NOTES

1. Refer to "Moody Standard Drawings R0007" dated January 2000, "Standard Specifications for Roads and Structures" dated January 2000 and all applicable sections of the latest version of the generic Project Special Provisions. The PSP can be accessed at the following website:  
<http://www.dot.state.nv.us/contract/traffic/Specs/ea/default.htm>
2. Pavement markings are existing.
3. Maximum times shown in timing chart are for free-run operation only. Coordinated signal system timing values shall supersede these values.
4. Set detector units to presence mode.
5. 332 Type cabinet shall include cabinet extension for coiled fiber optic storage.
6. 3020L Closed Loop System Data Controller ASSET MCV 0162
7. Do not program signal for late night flashing operation unless otherwise directed by engineer.
8. These loops serve as queue backup detectors. After 5 seconds of constant saturation, the detector unit passes a call to the controller to force off one phase in the cycle and go to phase 7 to clear out the storage loops.



PREFEPT 2

2070 BACKUP PREEMPTION	
Interval 1 - Dual Green	270
Interval 1 - Dual Yellow	0.8
Interval 1 - Dual Red	0.8
Interval 2 - Full Green	0
Interval 2 - Yellow	0.8
Interval 2 - Red	0.8
Backup Time	5
Min Green Before Pk	0
Red Clear Before Pk	8
Yellow Clear Before Pk	5.0
Red Clear Before Pk	2.8
Green Min Time	21
Enable Backup Preemption	0
Red Clear Through Red	0

- Reverts file defaults to file used for phase during normal operations.

[illegible]

\* These values may be field adjusted. Do not adjust Min Green and Extension times for phases 2 and 6 lower than what is shown. Min Green for all other phases should not be lower than 4 seconds.



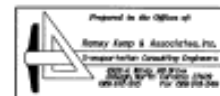
## 2070L LOOP & DETECTOR INSTALLATION

INDUCTIVE LOOPS				DETECTOR PROGRAMMING				
LOOP	30S #1701	TUNING	DISTANCE FROM STARTING PT)	PHASE	CAUSING OUTROUSE	TIME LEFT TILL TIME OUT	DETECTOR TIME RECS	RELAY TIME RECS
1A	03/00	2-0-0	0"	-	03	Y	Y	-
2K/57	63/05	5	300'	-	02	Y	Y	-
2B/58	63/05	5	300'	-	02	Y	Y	-
75/20	63/05	4	90'	-	02	DISABLE DETECTORS		
3A	03/00	2-0-0	0"	-	03	Y	Y	-
3B	03/00	2-0-0	0"	-	03	Y	Y	-
4A	03/00	2-0-0	0"	-	04	Y	Y	-
4B	03/00	2-0-0	0"	-	04	Y	Y	-
5A	03/00	2-0-0	0"	-	05	Y	Y	-
5B	03/00	2-0-0	0"	-	05	Y	Y	-
5A/55	63/05	5	300'	Y	06	Y	Y	15
6A/56	63/05	5	300'	Y	06	Y	Y	-
6C/63	63/05	4	90'	-	06	DISABLE DETECTORS		
7A	03/00	2-0-0	0"	-	07	Y	Y	-
7B	03/00	2-0-0	0"	-	07	Y	Y	-
8A	03/00	2-0-0	0"	-	07	Y	Y	-
8B	03/00	2-0-0	0"	-	08	Y	Y	-
Q1	03/00	4	270'	Y	08	Y	Y	10
Q2	03/00	4	270'	Y	09	Y	Y	-

### PROPOSAL

LEGEND

## EXISTING



## SIGNAL REVISION



US 284 (Raleigh Road)  
at  
SR 1165 (Forest Hills Rd)

Division 4		Wilson County	
Case No.:	1-18-04	Report No.	000
Arrested By:	000	Arrested On:	000000

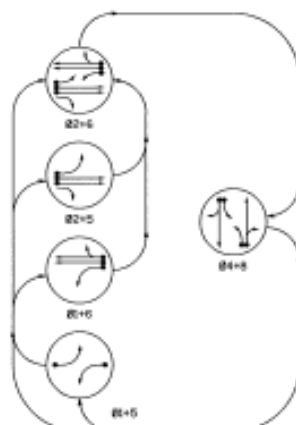
STANDARD BUREAU BACKUP DETECTION	FILE #
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**SEAL**  
Not a certified document as  
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This document originally  
issued and dated by  
Donald D. Smith, PE on 10/13  
on 5/20/04  
This document is only certified  
as to the recipient.

# **US 264 Alternate (Second Signal) (One Backplate Eastbound)**



# PHASING DIAGRAM



**PHASING DIAGRAM DETECTION LEGEND**  
 —→—→ DETECTED MOVEMENT  
 —→—→ UNDETECTED MOVEMENT (OVERLAP)  
 —→—→ UNSIGNALIZED MOVEMENT  
 —→—→ PRIORITY MOVEMENT

## TABLE OF OPERATION

SIGNAL FACE	PHASE					
	Ø1+6	Ø1+5	Ø2+6	Ø2+5	Ø3+6	Ø4+5
Ø1	R	R	G	G	R	Y
Ø2, Ø3	R	R	G	G	R	Y
Ø4, Ø5	R	R	G	G	R	Y
Ø6	R	R	G	G	R	Y
Ø7	R	R	G	G	R	Y
Ø8, Ø9	R	R	G	G	R	Y

## SIGNAL FACE I.D.

○ Denotes I.D.D.



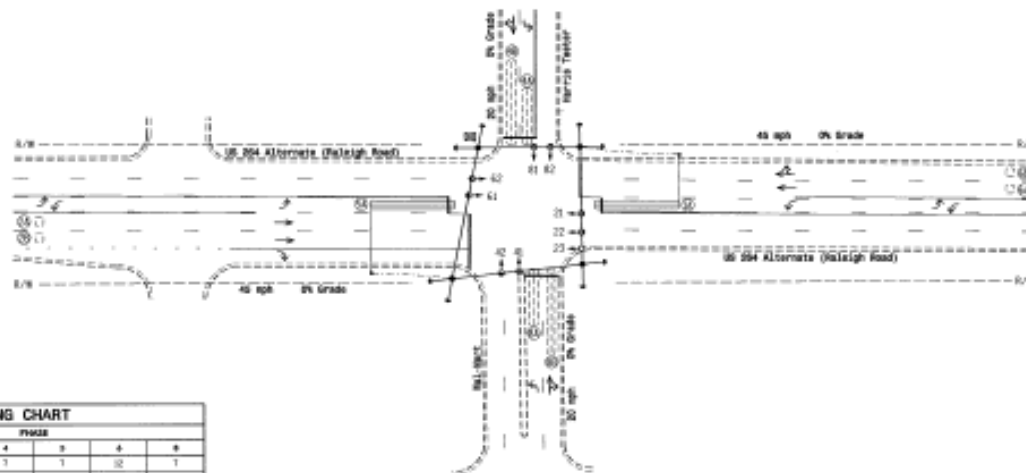
## 2070L LOOP & DETECTOR INSTALLATION

INDUCTIVE LOOPS				DETECTOR PROGRAMMING			
LOOP	BOX	AREA	DETECTOR	NAME	ADDRESS	TIME	TIME
1A	6x60	2-4-2	+5	Y	Y	Y	Y
2A	6x6	Ø2206	300	-	Y	Y	Y
2B	6x6	Ø2206	300	-	Y	Y	Y
4A	6x60	2-4-2	+5	-	Y	Y	Y
4B	6x60	2-4-2	+5	-	Y	Y	Y
5A	6x60	2-4-2	+5	Y	Y	Y	Y
5B	6x6	Ø2206	300	-	Y	Y	Y
6A	6x6	Ø2206	300	-	Y	Y	Y
6B	6x6	Ø2206	300	-	Y	Y	Y
8A	6x60	2-4-2	+5	-	Y	Y	Y
8B	6x60	2-4-2	+5	-	Y	Y	Y

5 Phase  
Fully Actuated  
(Wilson-US 264 Alternate  
Closed Loop Signal System)

## NOTES

- Refer to "Roadway Standard Drawings M0001" dated January 2002 and "Standard Specifications for Roads and Structures" dated January 2002.
- Do not program signal for late night flashing operation unless otherwise directed by the Engineer.
- Pavement markings are existing.
- Left phase 1 during phase 2 on.
- Left phase 5 during phase 6 on.
- Maximum times shown in timing chart are for free-run operation only. Coordinated signal system timing values shall supersede these values.
- Run new lead-in cable to each of the following loops: 2A, 2B, 6A and 6B. Wire these loops to separate detectors.
- Set all detector units to presence mode.
- Closed loop system data: Controller Asset #1008.



## 2070L TIMING CHART

FEATURE	PHASE					
	1	2	3	4	5	6
Left Green 1"	7	12	7	7	12	7
Extension 1"	5.0	6.0	5.0	5.0	6.0	5.0
Left Green 1"	15	16	15	15	16	15
Yellow Clearance	4.0	4.7	4.0	4.0	4.7	4.0
Red Clearance	2.0	3.0	2.0	2.0	3.0	2.0
Walk 1"	-	-	-	-	-	-
Clear/Walk 1	-	-	-	-	-	-
Seconds Per Activation *	-	1.5	-	-	1.5	-
Min. Variable Interval *	-	34	-	-	34	-
Clear Before Reduction *	-	15	-	-	15	-
Clear To Red * *	-	30	-	-	30	-
Minimum Gap	-	3.0	-	-	3.0	-
Fixed Mode	-	NON RECALL	-	-	NON RECALL	-
Vehicle Call Memory	-	YELLOW	-	-	YELLOW	-
Clear Delay	-	-	30	-	-	30
Clear/Minimum Gap	08	08	08	08	08	08

\* These values may be field adjusted. Do not adjust Min Green and Extension times for phases 2 and 4 from their value in chart. Min Green for all other phases should not be less than 4 seconds.

## PLAN QUANTITIES

Item	Per Item	Per Item
Signal Cable	510	
Message Cable	0	
Lead-in Cable	1250	

## LEGEND

PROPOSED	EXISTING
○ Traffic Signal Head	○ Traffic Signal Head
○ Modified Signal Head	○ Modified Signal Head
○ Sign	○ Sign
○ Pedestrian Signal Head	○ Pedestrian Signal Head
○ Sign Pole with Sign	○ Sign Pole with Sign
○ Signal Pole with Sidewalk Gap	○ Signal Pole with Sidewalk Gap
○ Inductive Loop Detector	○ Inductive Loop Detector
○ Controller & Cabinet	○ Controller & Cabinet
○ Junction Box	○ Junction Box
○ 2-in Underground Conduit	○ 2-in Underground Conduit
○ Right of Way	○ Right of Way
○ Directional Arrow	○ Directional Arrow
○ Pavement Marking Arrow	○ Pavement Marking Arrow

## Signal Upgrade

US 264 Alternate (Raleigh Road)  
at  
Wal-Mart/Harris Teeter

Version 4 Wilson County Wilson  
 Drawn by: J. P. Parker  
 Checked by: J. P. Parker  
 Date: 10/10/08  
 Scale: 1"=40'

PROJECT NO. 30318.2502 SHEET NO. 1

# **US 264 Alternate (Third Signal) (All Backplates Eastbound)**



# Backplates on Metal Poles



- Backplates are a major factor on the sizing of metal poles.
- Not so much the additional weight, but rather the additional wind surface area.
- Might require 20 -30 % increased strength of metal pole.

# Backplates on Signal Plans



- If the traffic signal plan requires backplates, backplates must be present.
- If the traffic signal plan does not require backplates, then the installation of backplates goes beyond the minimum requirements of the traffic signal plans.
- Do not install backplates on metal poles unless shown on the traffic signal plan or unless a structural analysis has been performed.

# Retroreflective Border on Signal Backplates



- FHWA issued interim approval on February 6, 2002.
- Approval is for use of a yellow retroreflective strip between 1 to 3 inches wide around the perimeter of the backplate.
- A written request for approval must be submitted to the FHWA.
- NCDOT has NOT sought interim approval for use along the State Highway System.
- Thus, NOT currently approved for use on the State Highway System.

# Conclusion



- Field verify that backplates are necessary (sun glare, cluttered background, etc.).
- Be consistent in the application of backplates, especially along a corridor and on an intersection approach.
- Maintain backplates by replacing / repairing as necessary.
- If backplates do not exist but are required on the plans, take corrective action.

# **For Additional Information Contact:**



**Mr. Greg A. Fuller, PE**

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**E-mail: [gfuller@dot.state.nc.us](mailto:gfuller@dot.state.nc.us)**